

utterly destroyed with their contemporaries by the same cause, but merely migrated to regions more suited to them, as the climate and other conditions of this country changed.

Exhibits.—Bones, teeth, and part of the tusks of mammoth, and associated flint implements from Southall. A flint implement from the lacustrine (?) bed at the Mount, Ealing (190 to 200 O.D.) (See the author's paper, Proceedings Geologists' Association, vol. x. No. 4). A flint apparently worked by man from the Weybourn Crag, beneath the "Forest bed" near Cromer. A Palæolithic scraper found on the beach near Cromer, &c.

THE POISONOUS SNAKES OF THE BOMBAY PRESIDENCY.

AT a recent meeting of the Bombay Natural History Society, a paper was read by the Honorary Secretary, Mr. H. M. Phipson, on the "Poisonous Snakes of the Bombay Presidency." He produced for inspection specimens of the following poisonous snakes, all of them having been killed in the Presidency of Bombay.

Colubrine.—(1) *Ophiophagus elaps*; (2) *Naga tripudians*; (3) *Bungarus arcuatus*; (4) *Callophis trimaculatus*; (5) *Callophis nigrescens*.

Viperine.—(6) *Daboia elegans*; (7) *Echis carinata*; (8) *Trimeresurus anamallensis*; (9) *Hypnale nepa*.

With regard to the first species, the *Ophiophagus elaps*, it is perhaps the largest poisonous snake in the world, sometimes measuring over 15 feet. It is also called the "king cobra" or "hamadryad," and is not very common, though widely diffused, being found in the Andamans, the Philippines, Borneo, Java, and Sumatra. On account of expanding a "hood," it is frequently mistaken for the cobra, but the head-shields of the hamadryad differ very much from those of the cobra. The second species, *Naga tripudians*, or cobra, is found all over India, and up to the height of 8000 feet in the Himalayas. There are many varieties, differing in colour and marking, to which the natives give different names, thinking them distinct species; but in such matters the native knowledge is not very extensive. Thus they believe that all the hooded cobras are females, and that the males are harmless. What they call the male is in reality only the common Indian rat snake (*Ptyas mucosus*). They also state that the rat snake is proof against the poison of the cobra. But this is not the case. Last year the young ones hatched in the Society's rooms attacked a small Malay python put into their cage, when they were only a few days old, and bit at it viciously, and the python died in a few hours after its removal to another cage. Once a year, during the rainy season, the cobra lays from twelve to twenty eggs. In one specimen shown by Mr. Phipson, the young one is seen just as it is emerging from the egg. The tooth with which it cuts its way out is shed as soon as it has served its purpose. When born, the young cobras measured about $7\frac{1}{2}$ inches long, and were very fat; but at the end of a few months they were about 9 inches in length, but had lost all their plumpness. It is very remarkable that the original nutriment got out of the egg should be able to sustain them so long. On account of its timidity and the great ease with which it can be tamed, it is the only snake with which the snake-charmers will have anything to do. By attracting its attention with one hand, it may be easily seized round the body with the other; and so long as the hand or any other object is kept moving before its eyes, it will never turn to bite the hand that holds it. This is the simple fact the knowledge of which the charmers turn to such advantage in their well-known performances. The snake is taken from its basket, and a slight stroke across the back brings it at once into a defensive attitude. The constant motion of the musical instrument before the snake keeps it watchful and erect, and not the music produced. As a matter of fact, snakes have no external ears, and it is extremely doubtful whether the cobra hears the music at all. The charmers say that the adder of the East, the *Daboia*, has no ear for music, because they cannot operate on it as they do on the cobra. It is rather interesting to note that this has been the belief since David's time at least—"like the deaf adder that stoppeth her ear; which will not hearken to the voice of charmers." (3) The krait (*Bungarus arcuatus*) is an exceedingly poisonous snake, and is quite common in nearly every part of India. One specimen taken in the Bombay Presidency contained a "brown tree snake" (*Dipsas gokool*) and in another specimen was found a *Ptyas mucosus*, thus showing that this species eats snakes. The common *Lycodon*

auclis, one of the non-poisonous snakes, is very much like the krait, but they can be distinguished by the presence in the krait of large hexagonal scales down the centre of the back. (4) The *Callophis trimaculatus* has no popular name. It is undoubtedly poisonous, and lives on other snakes, very likely the Calamariæ. (5) *Callophis nigrescens*, which grows to about 4 feet in length, is black in the upper parts and red in the lower.

(6) The first class of the Viperine snakes is the *Daboia elegans* called by Europeans in India the Chain Viper and in Ceylon the Tic Polonga. The fangs are very long, and for this reason, together with its fierceness, it is the most dreaded snake in India. Its poison acts differently from that of the cobra. Its tenacity of life is really wonderful, it having been known to live for a whole year without food. The length of this snake rarely exceeds 5 feet. (7) The *Echis carinata* and the last-named class are the only true vipers in India. The harmless "brown tree snake" (*Dipsas gokool*) is frequently confused with the *Echis carinata*, but they are easily distinguished by the scales on the head of the latter, while the *Dipsas gokool* has plates or shields. (8) The green tree viper (*Trimeresurus anamallensis*) is one of the family of Crotalidæ or pit vipers, so named from the pit or cavity beneath the eye and the nostril, of which family the terrible rattlesnake of America is a member. In India there are eight species of Trimeresuri, but up to the present only one has been found in Bombay, though it has been stated that another species, *T. strigatus* has been seen far up the country. (9) The headquarters of the *Hypnale nepa*, or Carawala, are in Ceylon, but it is commonly found along the Malabar coast.

These classes include all the poisonous land-snakes. All the true sea-snakes are poisonous, and of these, amongst others, the following are in the Bombay collection: *Hydrophis niadema*, *Hydrophis robusta*, *Hydrophis curta*, *Hydrophis aurifasciatus*, *Hydrophis Phipsoni*, *Hydrophis Guntheri*, *Hydrophis Lindsayi*, *Hydrophis chloris*, *Enrhadrina bengalensis*, *Pelamis bicolor*.

SCIENTIFIC SERIALS.

Rendiconti del Reale Istituto Lombardo, May.—Foraminifera of Mount S. Colombano Lodigiano, by Dr. Ernesto Mariani. A classified list is given of these organisms, collected chiefly by Profs. Maggi and Balsamo Cuvelli in the district stretching from the right bank of the Lambro to within a few miles of the Po. The prevalence of Miliolidæ and allied forms shows that this fauna, which mostly still survives in the surrounding seas, flourished in the warm shallow waters which at a remote epoch flooded the plains of Lombardy.—On the use of the lucimeter in agriculture, by Prof. Giovanni Cantoni. The author's recent experiments with this instrument, first designed by Bellani, show that it is calculated to render great service to husbandry in combination with the thermometer and psychrometer.—Alberto Brambilla continues his paper on a certain class of algebraic surfaces; and Prof. A. Scarenzio has some remarks on the therapeutic properties of the arsenical thermal waters of Acquarossa, near Biasca, on the old St. Gothard road in the Canton of Ticino.

June 7.—On the normal curves of genus p of various spaces, by Prof. E. Bertini. Clifford's fundamental theorem is here established by a more synthetic method than any hitherto published demonstrations. The theorem itself (*Philosophic Transactions*, 1878, p. 681) is here announced in the following modified form:—A curve of genus p and order $n > 2p - 2$ cannot belong to a space of more than $n - p$ dimensions.—On the proposed sanitary legislation for Italy, by D. C. Zucchi. A calculation is made that by the adoption of such measures as are enforced by the Local Government Boards in Great Britain, the average mortality of the population might be reduced from over 27 to under 20 per thousand. This is shown to be equivalent to the rescue of 100,000 lives, whose labour for 300 working days represents an annual sum of nearly £5,000,000 at present lost to the nation.—Meteorological observations made at the Royal Observatory of Brera, Milan, for the month of May.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 14.—"The Minimum-point of Change of Potential of a Voltaic Couple." By Dr. G. Gore, F.R.S.

In this communication is described the following very simple method of detecting the influence of the minimum proportion of

chlorine or other soluble substance, &c., upon the electromotive force of a voltaic couple (see NATURE, vol. xxxviii. p. 117).

Take a voltaic couple, composed of an amalgamated strip of zinc or magnesium (the latter is usually the most sensitive), and a small sheet of platinum, immersed in distilled water; balance its electric potential through an ordinary galvanometer of about 100 ohms resistance by that of a precisely similar couple composed of portions of the same specimens of the same metals, immersed the same moment as the other pair in a separate quantity of the same water; and gradually add to one of the two cells sufficiently small and known quantities of an adequately weak solution of known strength in a portion of the same water, of the substance to be used, until the balance is upset, and take note of the proportions of the substance and of the water then contained in that cell. In the present experiments a magnesium platinum couple was employed.

The minimum proportions required with several substances were as follows: potassic chloride, between 1 part in 3875 and 4650 parts of water; potassic chlorate, between 1 in 4650 and 5166; hydrochloric acid, between 1 in 516,666 and 664,285; and with chlorine between 1 in 15,656,500,000 and 19,565,210,000.

The proportion required of each different substance is dependent upon very simple conditions, viz. unchanged composition of the voltaic couple, a uniform temperature, and employing the same galvanometer. The apparently constant numbers thus obtained may probably be used as tests of the purity or of the uniformity of composition of the dissolved substances.

The "minimum-point" varies with—(1) the chemical composition of the liquid; (2) the kind of positive metal; (3) to a less degree with the kind of negative metal; (4) the temperature at the surface of the positive metal, and at that of the negative one; and (5) with the kind of galvanometer employed.

The order of the degree of sensitiveness is manifestly related to that of the degree of free chemical energy of the liquid; also to the atomic and molecular weights of the dissolved substances, and to the ordinary chemical groups of halogens. The greater the degree of free chemical energy of the dissolved substance, and the greater its action upon the positive metal, the smaller the proportion of it required to change the potential.

As the "minimum point" of a chemically active substance dissolved in water is usually much altered by adding almost any soluble substance to the mixture, measurements of that point in a number of liquids at a given temperature with the same voltaic pair and galvanometer will probably throw some light upon the degree of chemical freedom of substances dissolved in water.

"On the Change of Potential of a Voltaic Couple by Variation of Strength of its Liquid." By Dr. G. Gore, F.R.S.

This paper contains a series of tables of measurements of the electromotive forces of a voltaic couple composed of amalgamated zinc and platinum in distilled water, and in aqueous solutions of different strengths of the following substances: potassic chlorate, potassic chloride, hydrochloric acid, and bromine. The measurements were made by balancing the potential of the couple by that of a suitable thermo-electric pile (Proc. Birm. Phil. Soc. vol. iv. p. 130) through an ordinary astatic galvanometer of about 100 ohms resistance.

The following are the minimum proportions of those substances required to change the potential of the couple in water: potassic chlorate, between 1 in 221 and 258 parts of water; potassic chloride, between 1 in 695,067 and 1,390,134; hydrochloric acid, between 1 in 9,300,000 and 9,388,185; and of bromine, between 1 in 77,500,000 and 84,545,000 parts.

With each of these substances a gradual and uniform increase of strength of the solution from the weakest up to a saturated one was attended by a more or less irregular change of electromotive force.

By plotting the quantities of dissolved substance as ordinates to the electromotive forces as abscissæ, each substance yielded a different curve of variation of electromotive force by uniformly changing the strength of its solution, and the curve was characteristic of the substance. As the least addition of a foreign soluble substance greatly changed the "minimum-point," and altered the curve of variation of potential, both the curve and the minimum proportion of a substance required to upset the balance of the couple in water may probably be used as tests of the chemical composition of the substance, and as means of examining its state of combination when dissolved. By varying the strength of the solution at each of the metals separately, a

curve of change of potential was obtained for each positive metal, but not for every negative one.

"Influence of the Chemical Energy of Electrolytes upon the Minimum-point and Change of Potential of a Voltaic Couple in Water." By Dr. G. Gore, F.R.S.

By means of a zinc-platinum voltaic couple in distilled water, with its electromotive force balanced by that of a suitable thermo-electric pile¹ (Birm. Phil. Soc. Proc. vol. iv. p. 130), the effect of several groups of chemical substances upon the potential of the couple was examined. Measurements were made of the electromotive forces of a series of strengths of solution of each substance, and the results are given in a series of tables.

The minimum proportions of substance required to change the potential of the couple in water were as follows:—

Potassic iodate, between 1 in	443 and	494
„ bromate „ 1 „	344 „	384
„ chlorate „ 1 „	221 „	258
„ iodide „ 1 „	15,500 „	17,222
„ bromide „ 1 „	66,428 „	67,391
„ chloride „ 1 „	695,067 „	704,540
Iodine . . . „ 1 „	3,100,000 „	3,521,970
Bromine . . . „ 1 „	77,500,000 „	84,545,000
Chlorine . . . „ 1 „	1,264,000,000 „	1,300,000,000

On comparing these numbers we find that the proportion of substance required to upset the voltaic balance was largest with the oxygen salts, intermediate with the haloid ones, and least with the free elementary halogens. It was smaller the greater the degree of chemical energy of the substance; thus it was about 400 times less with chlorine than with iodine. And it was smaller the greater the degree of freedom to exert that energy; thus it was about 5,416,000 times less with free chlorine than with potassic chlorate, or 1,570,000 times less than with the combined chlorine of the chlorate, and about 185 times smaller than with potassic chloride, or 88 times less than with the combined chlorine of that salt.

The order or curve of variation of potential by uniform increase of strength of the solution was different with each substance, and was apparently characteristic of the body in each case. A great number of such representative curves might be obtained with a zinc platinum or other voltaic couple in different electrolytes.

June 21.—"Further Researches on the Physiology of the Invertebrata." By A. B. Griffiths, Ph.D., F.R.S. (Edin.), F.C.S. (Lond. and Paris), Principal and Lecturer on Chemistry and Biology, School of Science, Lincoln; Member of the Physico-Chemical Society of St. Petersburg. Communicated by Sir Richard Owen, K.C.B., F.R.S.

I. The Renal Organs of the Asteridea.

The digestive apparatus of *Uraster rubens* (one of the Asteridea) is briefly described as follows:—The capacious mouth, found upon the oral side, leads into a short œsophagus, which opens into a wider sacculated stomach with thin distensible walls. There are five large stomach sacs; each of these is situated in radial position and passes into the base of the corresponding ray. Each sac or pouch is kept in its place by two retractor muscles fixed to the median ridge of the ray, which lie between the two ampullæ or water-sacs. Passing towards the aboral side, the stomach forms the well-known pentagonal "pyloric sac." The pyloric sac gives off five radial ducts, each of which divides into two tubules bearing a number of lateral pancreatic follicles, whose secretions are poured into the pyloric sac and intestine. The author has proved the nature of this secretion to be similar to the pancreatic fluid of the Vertebrata (Edinburgh Roy. Soc. Proc., No. 125, p. 120). Recently, the secretion found in the five pouches of the stomach (of *Uraster*) has been submitted to a careful chemical and microscopical examination. With a quantity of the secretion uric acid crystals were extracted by the same methods as described in his previous papers (Proc. Roy. Soc., vol. xlii. p. 392, vol. xxxviii. p. 187).

The tests proved the entire absence of urea in the secretion under examination. No guanin or calcium phosphate could be detected in the secretion, although the author has found the latter compound as an ingredient in the renal secretions of the Cephalopoda and the Lamellibranchiata (Edinburgh Roy. Soc. Proc., vol. xiv. p. 230).

¹ This instrument is manufactured by Messrs. Nalder Bros., Horseferry Road, Westminster

From this investigation, the isolation of uric acid proves the renal function of the five pouches of the stomach of the Asteridea. These pouches are the homologues of the organs of *Bojanus* and nephridia in the Mollusca, the green glands of the Crustacea, and the segmental organs of worms.

II. The Salivary Glands of *Sepia officinalis* and *Patella vulgata*.

The author has already made a complete study of the nephridia and the so-called "livers" in both these forms of the Invertebrata (see the memoirs, *loc. cit.*). Since then he has studied the chemico-physiological reactions of the secretion produced by the salivary glands of the cuttle-fish and the limpet; these organisms representing two important orders of the Mollusca.

1. *Sepia officinalis*.

There are two pairs of salivary glands in *Sepia officinalis*. The posterior pair, which are the largest, lie on either side of the oesophagus. The secretion of the posterior glands is poured into the oesophagus, while the secretion of the smaller anterior pair of glands passes directly into the buccal cavity. This secretion was tested by similar reactions to those described in a former paper (Edinburgh Roy. Soc. Proc., vol. xiv. p. 230) and with similar results.

There is much in favour of the supposition that the *diastatic ferment* found in these secretions is produced as the result of the action of nerve-fibres (from the inferior buccal ganglion) upon the protoplasm of the epithelium cells of the glands.

The author intends to examine various organs in other genera and species of the Decapoda; especially those inhabiting the Japanese seas.

2. *Patella vulgata*

The two salivary glands of *Patella* are well-marked and situated anteriorly to the pharynx, lying beneath the pericardium on one side, and the renal and anal papillæ on the other. They are of a yellowish-brown colour and give off four ducts. The secretion of these glands was examined by the same method applied to the salivary glands of *Sepia officinalis*, and with similar results.

The following table represents the constituents found in the salivary secretions of the two orders of the Mollusca already investigated:—

	Cephalopoda.	Gasteropoda.	
	(a) Dibranchiata.	(a) Pulmogasteropoda. ¹	(b) Branchiogasteropoda.
Soluble diastatic ferment	present	present	present
Mucin	present	...	present
Sulphocyanates	present	?	present
Calcium phosphate..	present	?	present

From these investigations, the salivary glands of the Cephalopoda and Gasteropoda are similar in physiological function to the salivary glands of the Vertebrata.

III. The "Liver" of *Carcinus mœnas*.

The "liver" of *Carcinus mœnas* consists of two large glands on each side of the stomach, and extending the whole length of the cephalo-thorax. These organs are of a yellow colour, and consist of numerous caecal tubes arranged in tufts which are easily seen in a dissection beneath the surface of water.

The secretion of the so-called "liver" of *Carcinus mœnas*, when freshly killed, gives an acid reaction.

From the reactions detailed in the paper the conclusion to be drawn is that the so-called "liver" of *Carcinus mœnas* is pancreatic in function, *i.e.* its secretion is more like the secretions of the pancreas of the Vertebrata than those of a true liver.

Some biologists look upon the vertebrate liver, pancreas, and salivary glands as differentiated bodies of an original pancreas of the Invertebrata. But have not very many forms of the lower animals similar salivary glands to those found in the Vertebrata? And is not the so-called "liver" of the Invertebrata a true pancreas capable of producing the same chemical and physiological reactions as the pancreas of higher forms?

¹ Edinburgh Proc. Roy. Soc., vol. xiv. p. 236.

Physical Society, June 23.—Prof. Reinold, F.R.S., President, in the chair.—The following communications were read:—
The photometry of colour, by Captain Abney, F.R.S. This relates to the measurement of light reflected from coloured surfaces and pigments as compared with the quantity reflected from white or black. The apparatus used in the investigation consisted of a spectroscope and camera similar to those used by the author for the production of a patch of monochromatic light, and a small shadow photometer served for the measurement. The screen was made of two parts—one the colour to be tested, and the other white or black according to the standard being used; and the stick was arranged so that the shadows fell near the junction of the two parts. Light reflected from the surface of the first glass prism served to illuminate one shadow; and for the other, monochromatic light of any desired colour could be used. The intensities were adjusted to equality by cutting off more or less of the stronger light by means of a revolving wheel with adjustable sectors, the opening of the sectors being a measure of the luminosity of the pigment. In another arrangement a double-image prism was used to separate the spectrum into two parts. Monochromatic light from one part passed direct to the screen through sectors in a rotating wheel, and monochromatic light from the other spectrum was reflected on the screen at a sufficient azimuth to give a separate shadow, by means of two total reflection prisms. The losses by reflection were allowed for by observing the position of the adjustable sectors required to give equal intensities on a white screen. From the results obtained "colour curves" can be plotted for different pigments, &c., and templates constructed which, when rotated in the path of a spectrum, reproduce the corresponding colour. Carmine, sky-blue, and gold were thus reproduced. By means of templates constructed from "colour curves" any colour may be reproduced at any future time. In course of the experiments many interesting observations on colour-blindness have been obtained by the author and General Festing, some of which were described. A question was asked as to whether it was possible to reproduce any given colour, for no two arc lights could be expected to give exactly equal intensities in all parts of the spectrum. Dr. Thompson requested information regarding the effect of absorption by the different thicknesses of the prism through which the light passed, and thought the results obtained might be different if prisms of other materials were used. The fact mentioned in the paper as to the sky being greenish is well known to artists, who usually mix cobalt blue with yellow to produce the required tint. Dr. Thompson also reminded the members of an experiment he brought before the Society some years ago, in which grass seen through a solution of permanganate of potash appears bright crimson when compared with red colours seen through the same solution. In reply, Captain Abney said that colours could be imitated whatever the source used to produce the spectrum, for the resulting colour is the same as that seen when the "original" is viewed by light from that source. Regarding absorption, &c., by the prism, he did not think any appreciable difference was produced, for the results obtained when using the recomposed spectrum as white light were the same as those got by using light reflected from the surface of the first prism. In conclusion, he directed the attention of physicists to Lord Rayleigh's papers on sky colours, &c., published in the *Phil. Mag.*, which would well repay very careful study.—Note on continuous current transformers, by Prof. S. P. Thompson. Two classes of transformers are considered, *viz.* *motor-generators* and *commuting transformers*, in which a two-circuit armature is fixed in a revolving magnetic field. Such a field may be produced by using a fixed gramme ring as the field-magnet, and rotating the brushes round its commutator. The formulæ obtained apply equally to both classes. If c_1 , c_2 be the numbers of primary and secondary wires on outside of armature; E_1 , E_2 , c_1 , c_2 , i_1 , i_2 , r_1 , r_2 , the E.M.F., potential difference at terminals, currents, and resistances of primary and secondary respectively, then it is shown that $e_2 = k c_1 - (r_2 + k^2 r_1) i_2$, where $k = \frac{c_2}{c_1}$, which is called the "co-efficient of transformation." Thus the potential difference is the same as if the dynamo part had its resistance increased by $k^2 r_1$. As the currents in the primary and secondary are in opposite directions, the effective self-induction will be very small, hence such machines can be run with little or no sparking. In a previous paper by the same author, similar properties as regards self-induction and resistance were shown to exist in alternating current transformers. From the above equation it is evident that a motor-generator cannot be

made to give constant potential when supplied at constant potential except when the internal resistances are very small; but by over-compounding the distributing dynamo the desired result may be obtained. Mr. Kapp agreed with the author as regards motor-generators running with little sparking, but thought the great difficulty in using them commercially would be in preserving the insulation between the circuits, if anything like 2000 volts were used in the primary. He also mentioned the method of producing a rotating field by alternating currents, recently described by Prof. Ferraris and Mr. Tesla, and thought it would be preferable to the one devised by the author of the paper. In reply, Dr. Thompson said that insulation could be easily maintained between the core and windings of brush armatures, and saw no reason why it should present very serious difficulties in continuous current transformers.—On an optical model, by Prof. A. W. Rücker, F.R.S. The model exhibited and described is to illustrate the character of the vibrations in a crystal cut parallel to the axis, when plane-polarized light is incident upon it. A rectangular glass box represents the crystal, and glass plates placed at short distances from each end imitate crossed Nicols. A rod, carrying coloured circular and elliptical rings and straight bars, passes along the axis of the box. These rings are intended to indicate the character of the vibration at the different points at which they are placed. The length of the crystal is supposed to be such that plane-polarized red rays emerge plane-polarized in the initial plane after being successively plane, elliptical, circular, elliptical plane, elliptical circular, elliptical and plane-polarized within the crystal. All the light is quenched by the analysing Nicol. Supposing light of greater frequency (say green) to be used, another rod with green ellipses, &c., is placed in the box, and illustrates that such light emerges elliptically polarized, one component only of which is stopped by the analyzer. This shows how plane-polarized white light, when passed through crystals placed between Nicols, may become coloured.—On a new barometer, by Mr. T. H. Blakesley. A uniform glass tube is sealed at one end and a thread of mercury introduced, inclosing a quantity of air. An observation is taken by noting the volumes, A and B, of the inclosed air (as indicated by the divisions on the scale) when the tube is placed vertically with its closed and open ends upward respectively. The height, H, of the barometer is given by the

formula $H = \frac{A + B}{A - B} l$, where l is the length of the mercury column in the tube. For convenience, l is made 10 inches. The whole instrument is very portable, weighing only 6 ounces, and measuring about 18 inches long.—In the absence of the author, a paper on the existence of an undulatory movement accompanying the electric spark, by Dr. Ernest H. Cook, was taken as read. When sparks pass between two points placed above a plate on which some powdered substance has been scattered, the particles arrange themselves in circular lines approximately concentric with the projection of the middle line joining the two points. The proximity of the lines is found to be very nearly constant for the same powder, independent of the intensity of the spark used, or the material of the plate. Different powders give different numbers of lines per inch, and mixtures, numbers between those corresponding to their constituents. A great number of substances have been tried, giving numbers between forty and eighty-eight per inch. These extreme numbers were obtained for chalk and silica respectively. The author has found no satisfactory hypothesis by which to explain the results. A number of photographs accompany the paper, showing the character of the figures produced. At the meeting, an apparatus made by the late Dr. Guthrie was exhibited, with which similar figures to those described in the paper could be obtained. It consists of a shallow elliptical dish covered by a glass plate. Sparks are passed between two small knots across one focus, and powder, sprinkled on the bottom, forms into circles about the other focus.

Anthropological Institute, June 26.—Francis Galton, F.R.S., President, in the chair.—Mr. Arthur S. Burr exhibited a collection of pottery and other objects from recent excavations in New Mexico.—Mr. H. O. Forbes exhibited a series of photographs taken by him in New Guinea.—A paper on the Nicobar Islanders, by Mr. E. H. Man, was read. Mr. Man has been resident at the Nicobars for periods amounting in all to about 7 years, viz., 1871–88; during that time he has prepared a vocabulary containing 6000–7000 words, and he has thus been in a position readily to make inquiries from the

natives on the various points of ethnological interest connected with their constitution and their culture, and to substantiate from a variety of independent sources all the information he obtained. After giving a description of the islands and sketch of their history, Mr. Man proceeds, working on the lines laid down in the Anthropological Notes and Queries, to a careful consideration of the constitution of the Nicobarese, which he prefaces with an outline of certain facts and ethnic characteristics in support of the racial affinities of the Nicobarese with the Indo-Chinese races. From measurements taken of 150–200 individuals at the different islands, Mr. Man gives the average height of the Nicobarese men as 5 $\frac{1}{2}$, and of the women as 5 feet, a result which disproves the statements of earlier writers regarding the disproportion which exists between the sexes in respect of size. The coloration of the skin pigment of the face, chest, back, arms, and thighs is found to differ in a more or less marked degree in each individual; the two former are usually of a distinctly lighter shade than the last three. Another error needing correction is the assertion that these people can carry without any trouble 200 cocoa nuts, or 5 cwts., whereas it appears that in spite of their undoubtedly fine physical development the maximum load which a Nicobarese can carry may be reckoned as from 160–180 lbs. In the absence of statistics it is difficult to speak with certainty, but from personal observations extending over 17 years it would seem that the average length of life among these islanders is higher rather than lower than it is among the natives of the adjacent continents: the extreme limit of life actually noted is a little over 70, and 80 may be regarded as the maximum ever attained. With reference to the numerical strength of the aboriginal population, a census taken by Mr. Man a year or two ago proves that nearly half the population of the group is contained in Car Nicobar, where a decided increase is taking place, as is also the case at Chowra Teressa and Bompoka. In the central and southern portions of the Archipelago the small ratio of the juvenile element points, however, to a diminution in those islands of the number of inhabitants. It is satisfactory to learn that, though not entirely exempt from the evils which seem inseparably connected with advance in civilization, it does not appear that the Nicobarese have suffered either physically or morally from their contact with Europeans during the past 19 years.

Entomological Society, July 4.—Dr. D. Sharp, President, in the chair.—Mr. Enock exhibited male and female specimens of a spider received from Colonel Le Grice, R.A., who had captured them at Folkestone on May 27 last. They had been submitted to the Rev. O. Pickard-Cambridge, F.R.S., who identified them as *Pellenes tripunctatus*, a species new to Britain. Mr. Enock also exhibited specimens of *Morisus destructor* (Riley), an American parasite of the Hessian fly.—Mr. Wallis-Kew exhibited larvæ of *Adimonia tanacetii* found in Lincolnshire feeding on Scabious.—Mr. Porritt exhibited a number of specimens of *Aretia mendica*, bred from a batch of eggs found last year on a species of *Rumex* at Huddersfield. Mr. Porritt said that this species, in the neighbourhood of Huddersfield, was often more spotted than the typical form, but he had never before seen anything approaching in extent the variation exhibited in these bred specimens. Out of forty-four specimens not more than eight were like the ordinary type of the species.—Mr. McLachlan exhibited specimens of *Faltingia longicauda* received from Rotterdam.—Mr. Jacoby exhibited the following species of Phytophagous Coleoptera from Africa and Madagascar, recently described by him in the Transactions of the Society, viz.:—*Lenia laticollis*, *Cladocera nigripennis*, *Oedionychis madagascariensis*, *Blepharida intermedia*, *B. nigromaculata*, *Chrysomela madagascariensis*, *Sagra opaca*, *Blepharida ornaticollis*, *B. laterimaculata*, *Mesodonta submetallica*, *Schematella viridis*, *Spiocephalus viridipennis*, *Apophyllia smaragdipennis*, *Aethonca variabilis*.—M. Alfred Wailly exhibited a large number of species of Lepidoptera and Coleoptera, recently received by him from Assam, from the West Coast of Africa, and from South Africa. He also exhibited eggs and living larvæ of *Bombyx cytheraea*, and made remarks on the life-history of the species.

Mineralogical Society, June 28.—Prof. Jas. Geikie, F.R.S., in the chair.—The following papers were read:—A mangano magnesian magnetite, by Prof. A. H. Chester, Hamilton College, U.S.A.—The distribution and origin of the mineral albatite in Ross-shire, by Hugh Miller, F.R.S., of H. M. Geol. Survey.—Elateite, a mineral tar in old red sandstone, Ross-shire,

by Mr. W. Morrison, Dingwall Academy.—These papers were accompanied by various analyses, by Prof. J. Macadam.—The rock-forming feldspars and their determination, by Mr. Alex. Johnstone, and A. B. Griffiths, F.R.S.E.—A Scottish locality for boruite, with analyses by Prof. Macadam, by Rev. W. W. Peyton.—Minerals of the Treshinish Isles, by Prof. Heddle.—On the zeolites of rye water, Ayrshire, by Prof. Heddle.—Prof. Macadam communicated various analyses of coals, of head dies, and of diatomite.—Minerals were exhibited by the Duke of Argyll, Dr. Balfour, Prof. Macadam, Mr. Peyton, and Dr. Black.

PARIS.

Academy of Science, July 9.—M. Janssen, President, in the chair.—On cyclones, by M. Mascart. Referring to M. Faye's last communication, the author accepts as a concession the remark that at all events in fixed depressions currents arise about the periphery, which have a more or less *convergent* tendency. He also quotes the full text from Mohn's work, showing that this meteorologist admits an *ascending* motion in tropical cyclones, and is consequently opposed to M. Faye's theory.—On the figure of the earth, by M. H. Poincaré. The object of these calculations is to ascertain whether it be possible to find a law for the varying density in the interior of the globe which shall satisfy at once (1) Clairaut's equation; (2) the observed value $\frac{2}{3}$ of the flattening; (3) the observed value 305.6 of the constant of the precession. The conclusion arrived at is that no hypothesis on the law of densities will satisfy these values.—The number of centenarians in France according to the census of 1886, by M. Emile Levasseur. Of the 184 returned as centenarians, 101 are shown to have been classed in this category by error. For 67 of the others no documentary evidence was forthcoming, leaving 16 whose claim to the honour appeared to be fairly well established. Joseph Ribas, the oldest, was born at San Estevan de Litera, in Spain, on August 20, 1770, and was still living at Tarbes in 1888, and is consequently now close upon 118 years old. The greater proportion belong to the south-western provinces, and as far as can be judged from available data there is no reason to suppose that they are either more or less numerous now than in former times.—Formula for the calculation of longitudes by means of chronometers, by M. Caspari. By the formula here worked out the author has determined a correction of 2".45 for Hai-Phong, Tongking, which differs little from the 2".93 which M. La Porte has recently obtained by the telegraph.—On the position of Timbaktu, by M. Caron. The approximate position of this place is found to be 16° 49' N. lat.; 5° 12' W. long., which differs considerably from Barth's 18° 3' 45" N.; 4° 5' 10" W.—On the determination of the constants and dynamic coefficient of elasticity of steel, continued, by M. E. Mercadier. These researches lead to the general conclusion that the strictly *elastic* properties shown in vibratory or other phenomena of a transitory nature should be carefully distinguished from the physical properties accompanied by permanent distortion. The former vary but slightly, the latter considerably in the different kinds of hard and soft steel.—On the propagation of the sound produced by firearms, by M. de Labouret. The apparent increase of velocity is explained with M. Journée on the hypothesis that the projectile at each successive instant of its motion through space is the centre of a fresh concussion. The series of observations here recorded gives results for the velocity of the sound, which are mainly in accordance with the theoretic calculations.—A new method for the measurement of the electric resistance of saline solutions, by MM. E. Bouty and L. Poincaré. A process is described by means of which the difficulties may be overcome, which are met with in the application of ordinary methods to salts in solution at temperatures ranging from 300° to 500° C. The results agree sufficiently well with those previously obtained by M. Foussercau by a different process for temperatures from 329° to 355° C.—Actino-electric researches, continued, by M. A. Stoletow. The author here describes an apparatus constructed by him for the purpose of studying the actino-electric currents in diverse gases and vapours, and under diverse pressures. At ordinary pressure he finds little difference between dry air, moist air, and hydrogen, while for carbonic acid the current is nearly twice as strong.—On some compounds of yttrium, by M. A. Duboin. To the few combinations of yttria hitherto obtained by the dry process the author here adds the silicate of yttria, gadolinite of pure yttria, and the crystallized oxide of yttrium.—Syntheses by means of cyanacetic ether, by M. Alb. Haller. By the process

already described for the preparation of the corresponding benzoyl, acetyl, propionyl, and other ethers, the author has succeeded in obtaining the synthesis of the orthotolyl, phenylacetate, cinnamyl, and dicinnamyl cyanacetic ethers.—On the alkaloids of cod liver oil, by MM. Arm. Gautier and L. Mourgues. It is shown that this substance contains several alkaloids, some very active: but the present paper deals mainly with the leucomaines obtained by the authors from the yellowish oils yielded both by the Norwegian and Newfoundland cod.—On paradoxal deafness and its treatment, by M. Boucheron. This curious affection, the paraconsia of Willis, in which the patient is deaf to words uttered in the silence of a room, but not in a noisy street, is here carefully studied and found to be a variety of otitis media.—A fishing basket for deep sea hauls, and an electric apparatus for illuminating the oceanic depths are described and illustrated, the former by Prince Albert of Monaco, the latter by M. P. Regnard.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Tabular List of Australian Birds: E. P. Ramsay (Sydney).—Flora of the North-East of Ireland: Stewart and Corry (Belfast Naturalists' Field Club).—Lewis's Medical and Scientific Library Catalogue (Lewis).—Charles A. Gillig's Tours and Excursions in Great Britain: S. F. Smart (United States Exchange).—Numerical Examples in Practical Mechanics and Machine Design: R. G. Blaine (Cassell).—Austrian Health Resorts: W. F. Rae (Chapman and Hall).—An Illustrated Manual of British Birds, Part 4: H. Saunders (Gurney and Jackson).—Euclid's Method or the proper way to treat on Geometry: A. H. Blunt.—Experimente über die Bacterienfeindlichen Einflüsse des Thierischen Körpers: Dr. G. Nuttall.—Annals of Botany, vol. 2, No. 5 (Frowde).—Annalen der Physik und Chemie, 1888, No. 86 (Leipzig).—The Auk, vol. v. No. 3 (New York).—Notes from the Leyden Museum, vol. x. No. 3 (Leyden).—Studies from the Biological Laboratory, Johns Hopkins University, vol. iv. No. 4 (Baltimore).

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